

BERSET

A MASK DETECTOR



PHYSICAL COMPUTING HS2020

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CONCEPT

In this module we have dealt with Empathetic Machines. The task was to make a prototype for a robot that shows empathic characteristics and anthropomorphic behavior, but should be kept in a basic geometric shape.

Suitable for the current COVID 19 situation we have built a robot called BERSER, which gets angry if the person in front of it does not wear a mask. As a reaction, he sprays disinfectant on him. There are different stages of anger, if the person in front of him wears the mask badly, the robot slowly gets angry and then sprays him if he does not put the mask on properly. If the person is not wearing a mask at all, he is injected immediately. If all persons in sight are wearing the mask correctly, the robot scans the environment in a 180 degree rotation.

We have dealt with the emotion of anger and have extracted the most important behavioral characteristics for us. We show the rising rage and the increased body function by the robot lighting up red from bottom to top. This and the spray reaction is enough to represent the emotion properly.

BRAINSTORMING

Emotionen Favoriten:

Baran:

1. Wütend (keine Maske → wirft etwas nach dir) (III)
2. Schüchtern (jemand ist da → Stop) (II)
3. Angepisst (Kopf fällt runter) (III)
4. Ängstlich (Schlange → will sich nicht ausschalten lassen) (III)

Kimon:

1. Zwang/ Zwanghaft/ Zwangsstörung/ Kontrollzwang ()
2. Stolz/ Balzverhalten (II)
3. Faszination/ fasziniert (I)

Daniela:

1. Imitieren / Spiegelnd → **Empathie** (III) (Emotionen erkennen)
2. Aufgedreht, Aufgeweckt, Euphorisch, Eifrig (I)
3. Beschämt, befangen (III)

At the beginning we dealt with different emotions and chose our three favourites. Everyone could then award points and the emotions with the most points went on to the next round.

Drei Punkte:



Wütend (keine Maske → wirft etwas nach dir) (III)

- Angepisst (Kopf fällt runter)()
- Ängstlich (Schlange → will sich nicht ausschalten lassen) (II)
- Imitieren / Spiegelnd → **Empathie** (Emotionen erkennen) ()
- Beschämt, befangen (I)

In the end, we decided on the emotion anger. Connected to this was the idea that the robot would become angry if the person in front of it did not wear a mask.

Funktionen Favoriten:

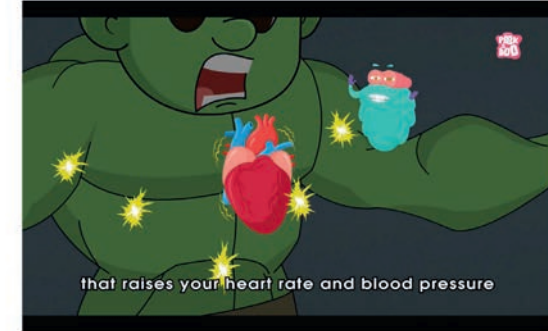
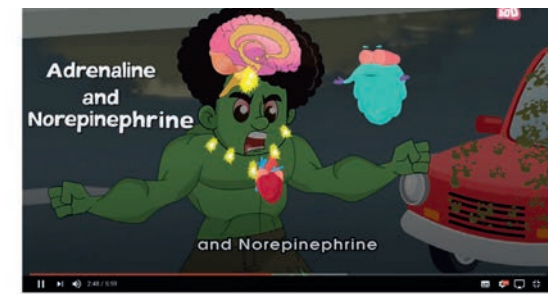
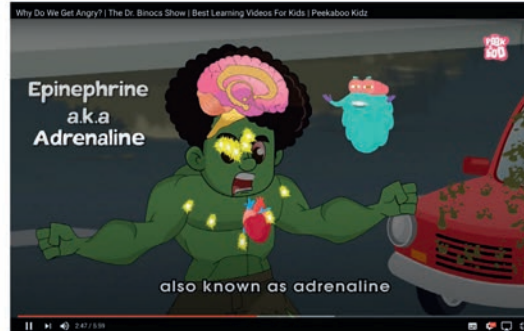
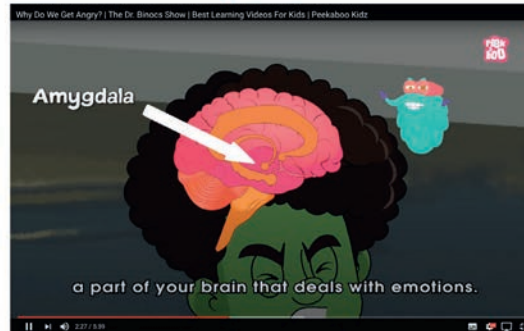
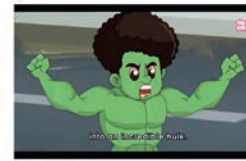
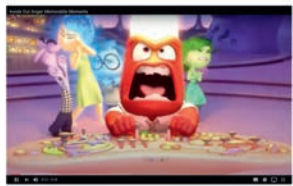
Mögliche Funktionen:

- Stossen
- Werfen
- Farben erkennen
- Gesichter/Emotionen erkennen
- Licht
- Sound
- Distanz Sensor
- Drehen/Kehren
- Runterfallen
- Aufheben
- Reagieren
- Spiegeln
- Kamera Bildaufnahme

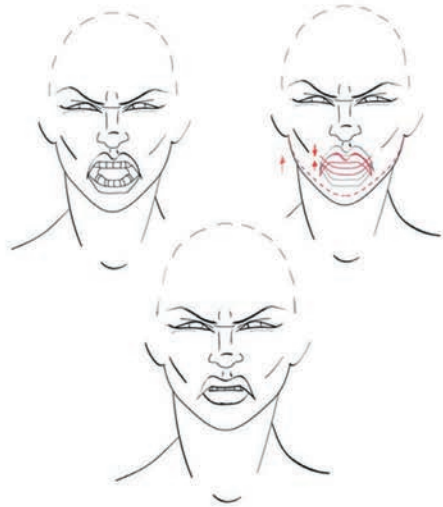
We also looked at various possible functions.

CHARACTERISTICS OF ANGER

In order to better understand the emotion “anger”, we did s desk research and looked around in the area of animation, as they usually personify it best.



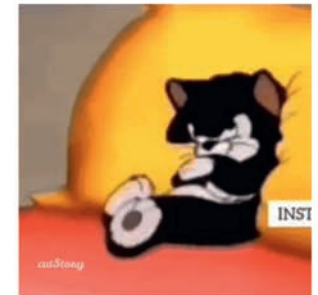
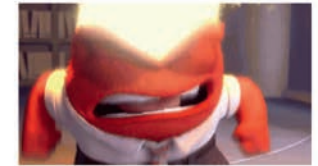
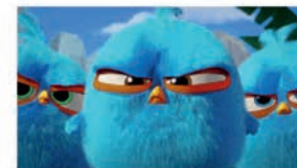
Comic Drawings



Cartoon Donald Duck Angry, HD Png Downlo...
 Cartoon Donald Duck Angry, HD Png Download is
 free transparent png image. Download and use it for
https://www.kindpng.com/imgofme/Tmxc_carto...

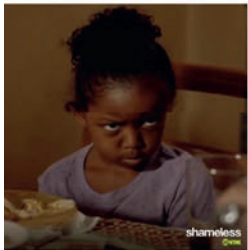


I Got Tagged By @pizzawolf20 To Come Up ...
 I Got Tagged By @pizzawolf20 To Come Up With
 Three - Angry Donald Duck Cartoon, HD Png
<https://www.pngitem.com/middle/xbbbh-j-got-...>



We also looked at drawings and comics that express the emotion of anger. We also looked for various GIFs to observe the movement.

Menschen:



How To Draw Angry Expressions

Learn how you can draw... or learn how to THINK when you DRAW with the Etherington Brothers! Learn how the shape of eyebrows and lips come into

<https://www.clipstudio.net/how-to-draw/archives/160355>



Human Anatomy Fundamentals: Mastering Facial Expressions

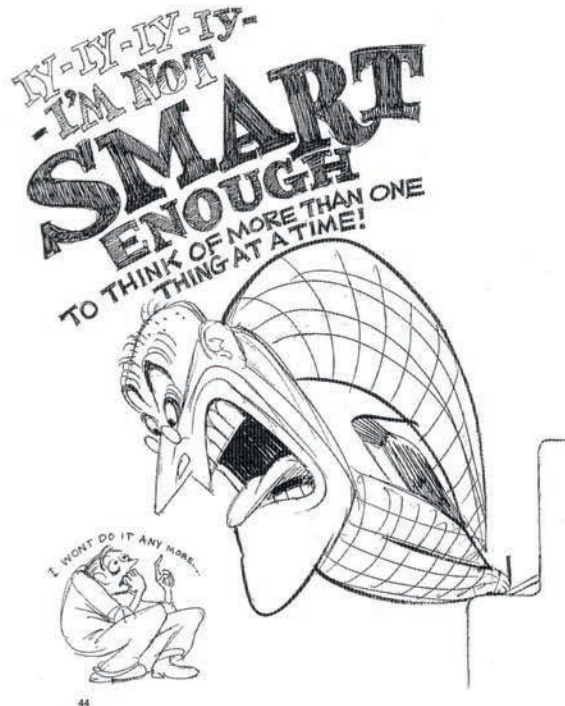
To anyone whose illustration work includes characters, facial expressions are like this computer monitor: if it doesn't work right, then all the brilliant

<https://design.tutsplus.com/tutorials/human-anatomy-fundamentals-...>

Nütend:

Wut veranlasst den einen, starr zu starren, ein sehr grundlegendes Verhalten, das darauf abzielt, den anderen kampflös zur Aufgabe zu zwingen.

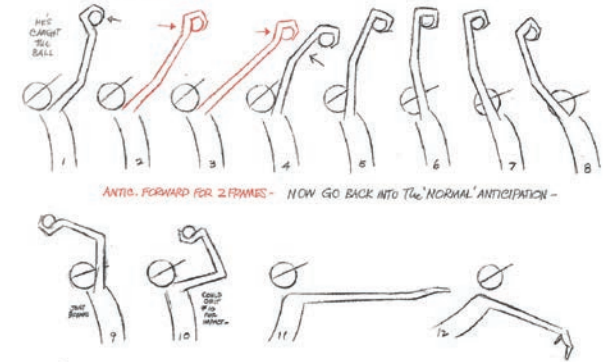
- Die Augenbrauen sind niedrig und deutlich verknötet, wodurch mehr Furchen entstehen.
- Die Nasenlöcher weiten sich, so dass die Flügellinien proportional zu der Abscheu gegenüber dem Objekt der Wut sichtbar werden.
- Der Mund ist zu einer Linie zusammengedrückt, die an den Mundwinkeln harte absteigende Linien aufweist.
- Eines der ersten Anzeichen von Wut ist eine unkontrollierbare Rötung der Ohren.
- Andere Anzeichen von Wut sind ein aufrechter Körper, dominante Zurschaustellung (Hände auf den Hüften oder zu Fäusten geballt, schlagende Gesten mit der Handfläche nach unten).



source: the Animator's Survival kit

THIS DEVICE GIVES AN EXTRA PUNCH TO AN ACTION BY INVISIBLY ANTICIPATING ANY ACTION. IT'S THE SAME THING AS A 'NATURAL' ANTICIPATION - JUST GO THE OPPOSITE WAY FIRST - BUT ONLY FOR ONE, TWO OR THREE FRAMES.

A BASEBALL PLAYER HAVING CAUGHT A BALL COULD ANTICIPATE THE ANTICIPATION OF HIS THROW FOR JUST 2 FRAMES -



source: the Animator's Survival kit

We also looked at the gestures and facial expressions of the people.

HOW THE BODY REACTS TO ANGER



https://hips.hearstapps.com/digitalspyuk.cdnds.net/13/26/showbiz-hugh-jackman-mens-health-3.jpg?resize=768:*

Emotions have evolved over time to respond as quickly as possible to vital events. The purpose of anger is to remove obstacles, through possible threat or attack.

The body goes on alert and releases stress hormones, the heartbeat accelerates and muscle tone increases.

Anger is one of the fastest emotions, which is like a short circuit in the brain. The eyebrows contract, the gaze becomes piercing, the lower jaw moves forward, teeth are shown or the lips become narrow.

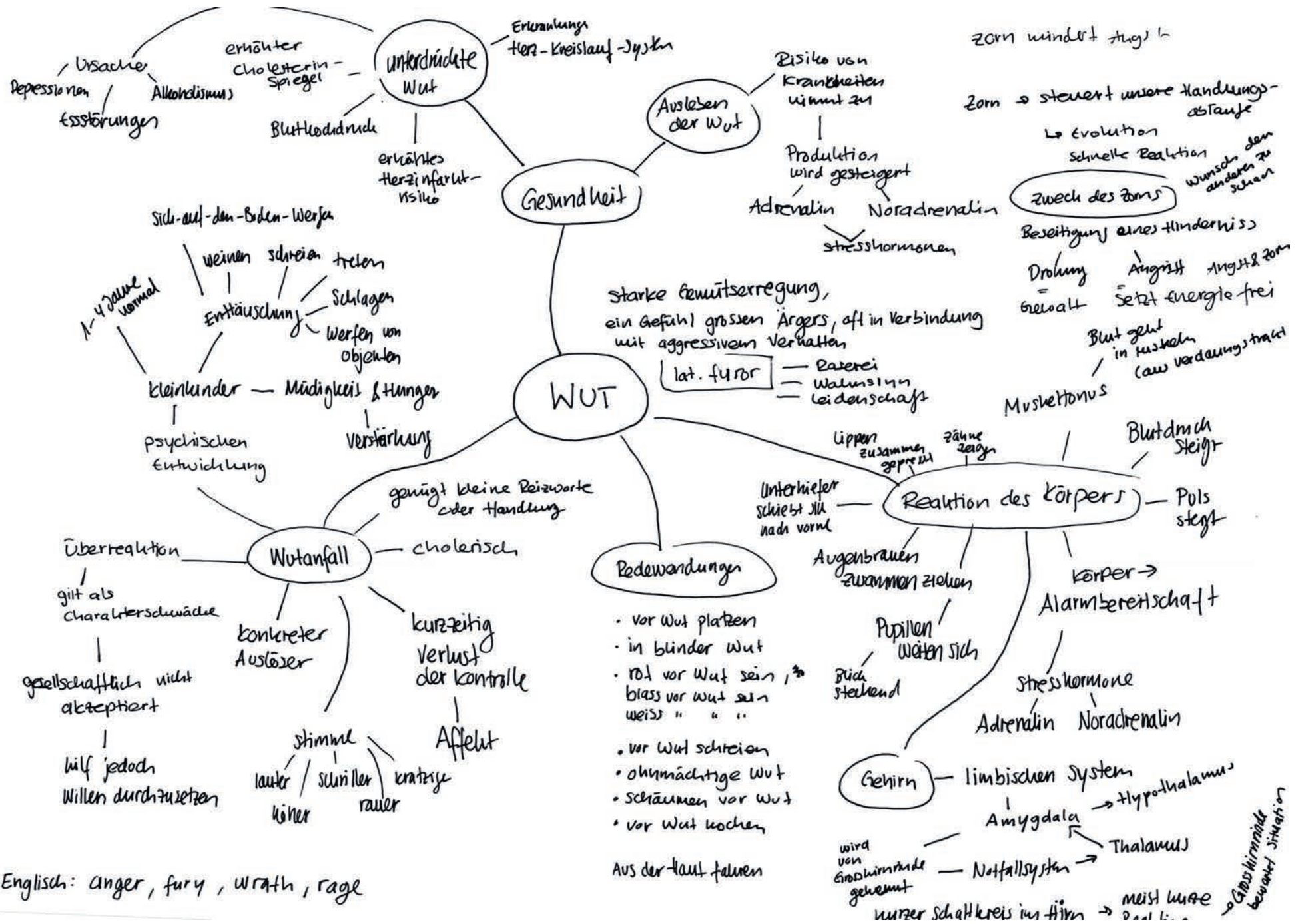
Reading Sources:

www.zeit.de/zeit-wissen/2016/02/emotionen-limbisches-system-amygdala-zorn?utm_referrer=https%3A%2F%2Fwww.google.com

www.geo.de/geolino/mensch/19476-rtkl-wut-warum-wir-manchmal-wuetend-werden-und-was-unserem-koerper-passiert

www.srf.ch/kultur/wissen/hirnforschung-was-wutausbrueche-von-anderen-bei-uns-bewirken

<https://de.wikipedia.org/wiki/Wut>



Englisch: anger, fury, wrath, rage

We read different texts about what happens to the body when we feel anger.

IDEAS FOR THE CONCEPT



Based on the findings of desk research, we eliminated the reactions to the points that were most important to us. The fast reaction is an important factor, the red of the head and the aggressive behaviour. The red will symbolise the heartbeat and the exploding.

Starting from the current situation with COVID 19, we wanted to build the robot, which gets angry if the person in front of it does not wear a mask.

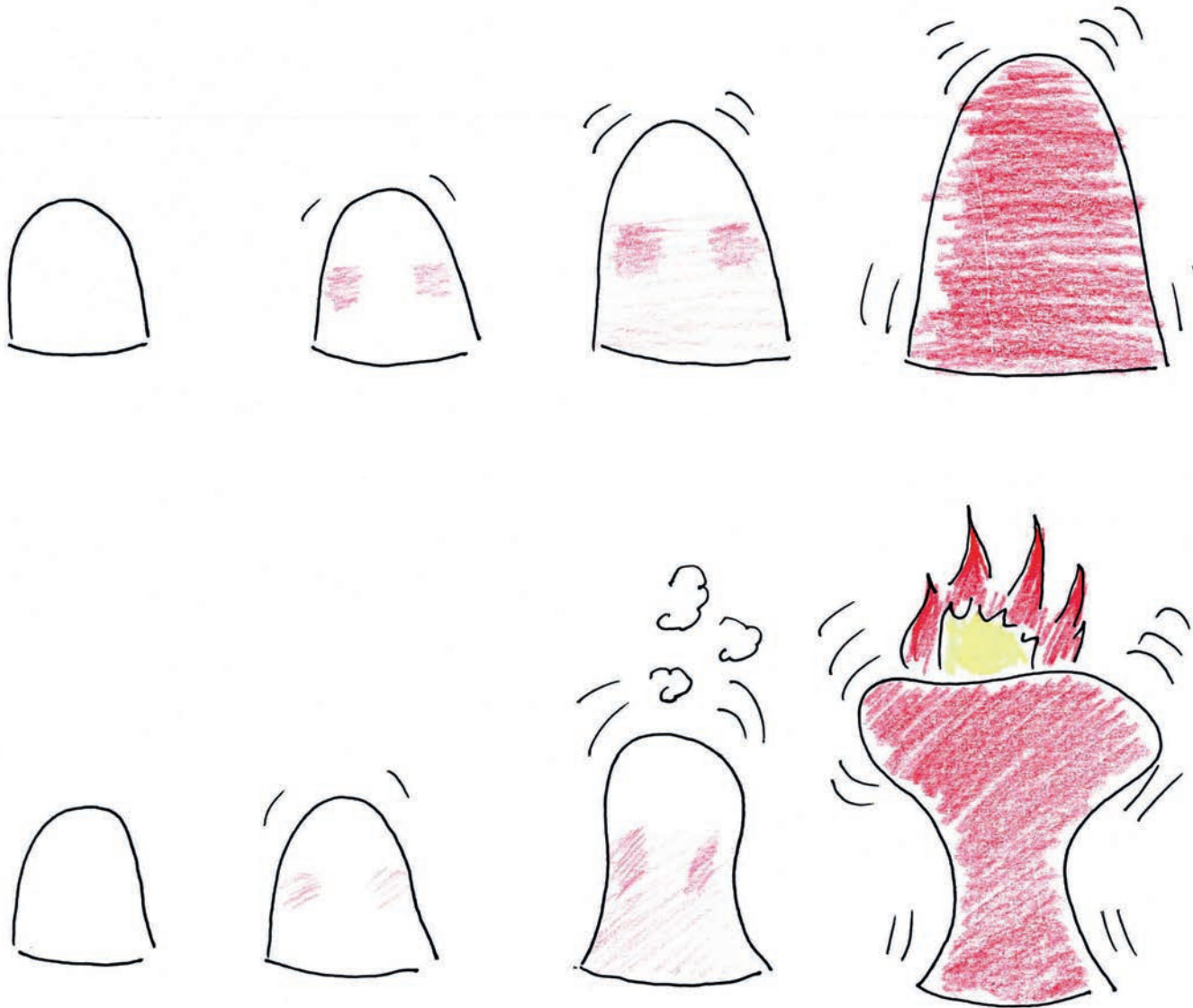
Our plan was to let the robot throw something first. But then, after mentoring, we decided to let it spray disinfectant and get a similar effect, maybe even more appropriate to the situation.

Ideen:

- Roboter wird immer röter je näher die Person kommt
- Er wirft dir eine verpackte Maske an
- Roboter wirft Nerf Darts
- Roboter wird langsam röter und wütender (zittern) je näher die Person kommt. Betritt sie den mind. Abstand von 1.50m wird der Roboter wütend und Beginnt zu Dampfen, plustert sich auf und wirft etwas.
- Roboter kann sich drehen und fokussiert die Person

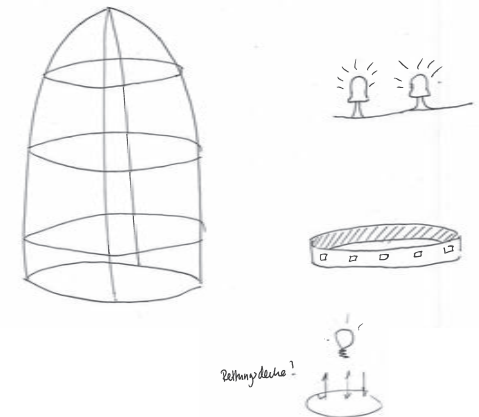
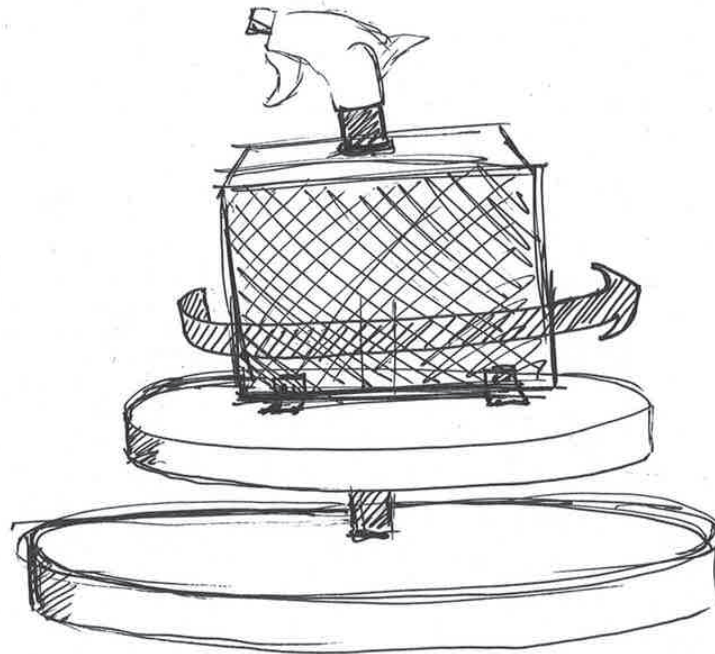
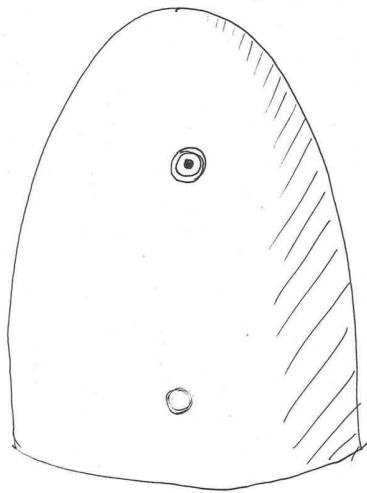
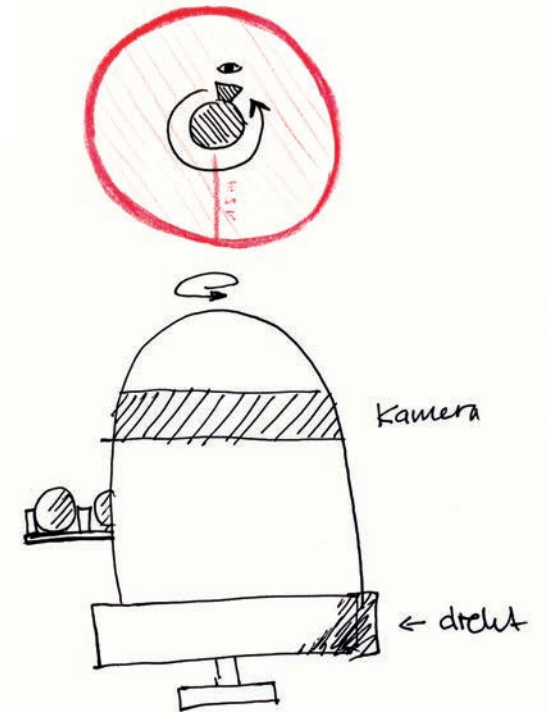
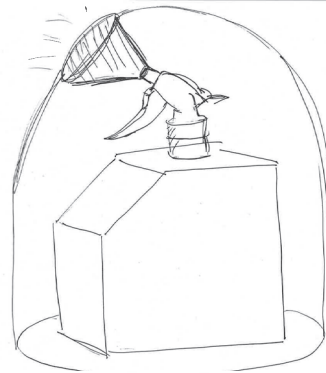
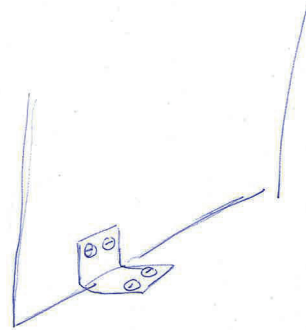
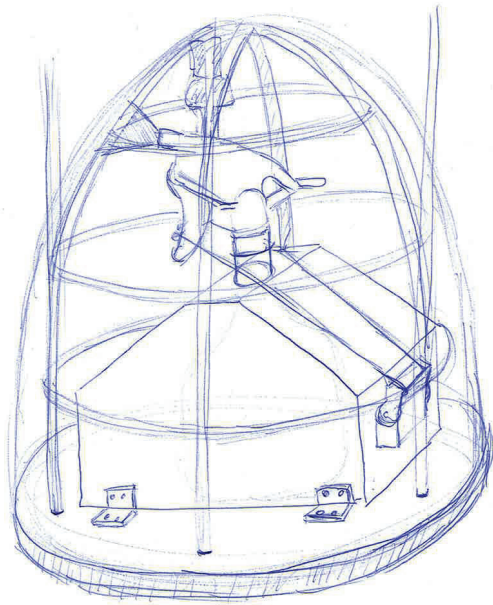
Development of ideas

FORM FINDING



Starting from the reaction to anger, which is important for us, we were looking for a form that does not immediately express anger or aggression. So we designed a basic form, which is round, because round is associated with pleasant and lovely.

Here we also tried to represent the reaction to anger, in a sequence. With getting redder and redder and trembling or with smoking and exploding.

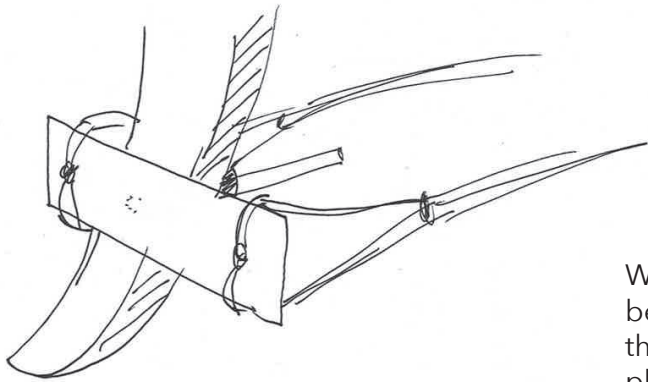


Various sketches for realisation ideas and communication within the team.

SPRAY FUNCTION



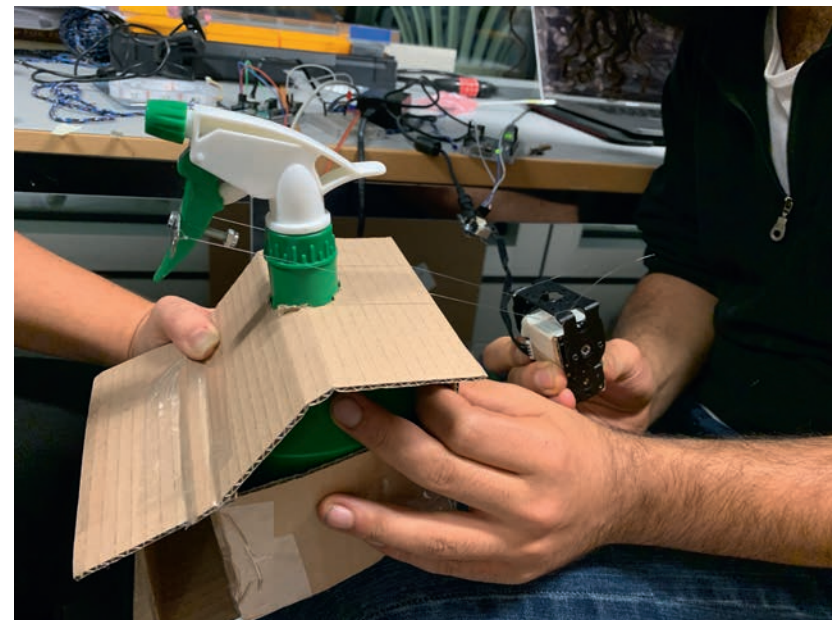
We are testing different ways and materials how we could activate the spray.



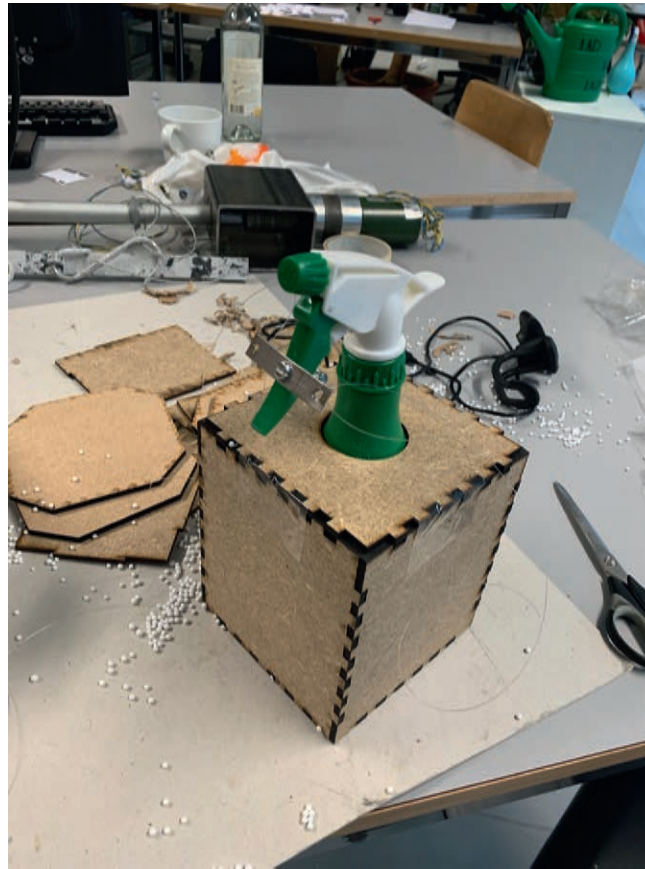
We came to the conclusion that the best way would be to screw something directly to the handle, using a plate as reinforcement and wire.

After a short sketch we implement the plan.



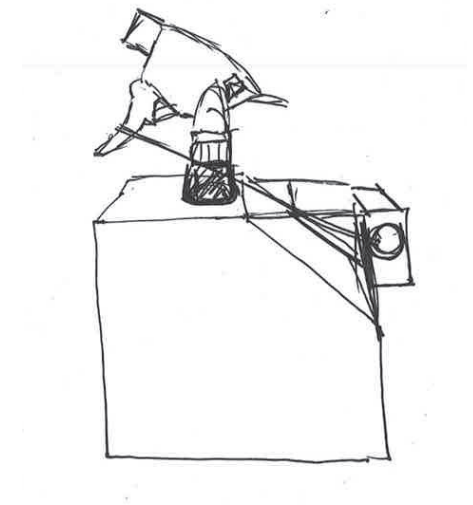


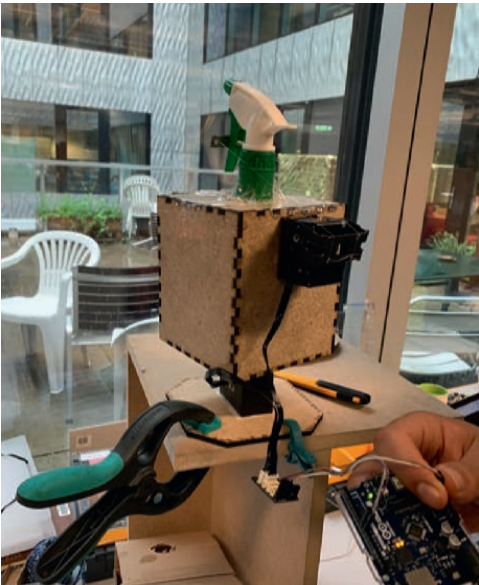
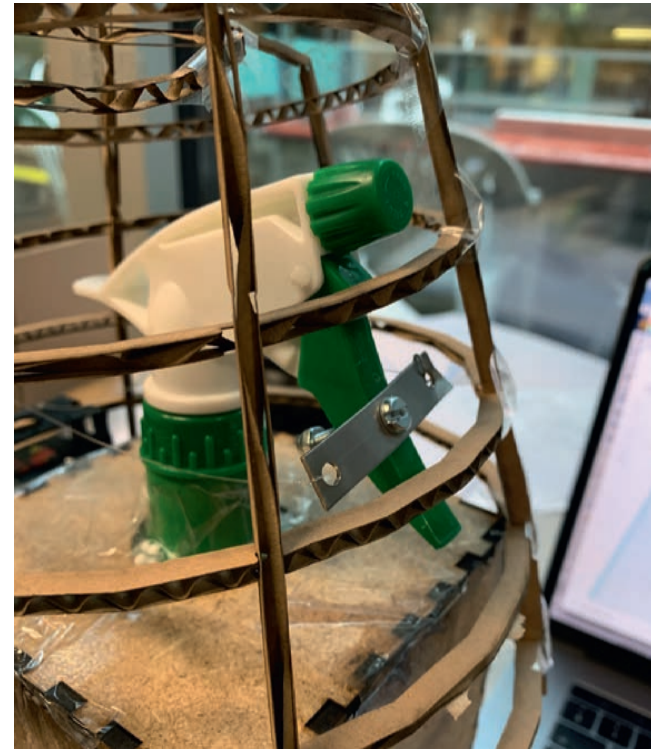
And the mechanism worked very well, even with the servo motor. To stabilize the spray and fix the servo motor, we built a cardboard box for further tests.



After the successful tests with cardboard, we implemented the project with MDF and filled it with styrofoam balls as additional stabilisation.

In the prototyping process we tried to work with as much recycled material as possible, which we found in our studio. To save resources.





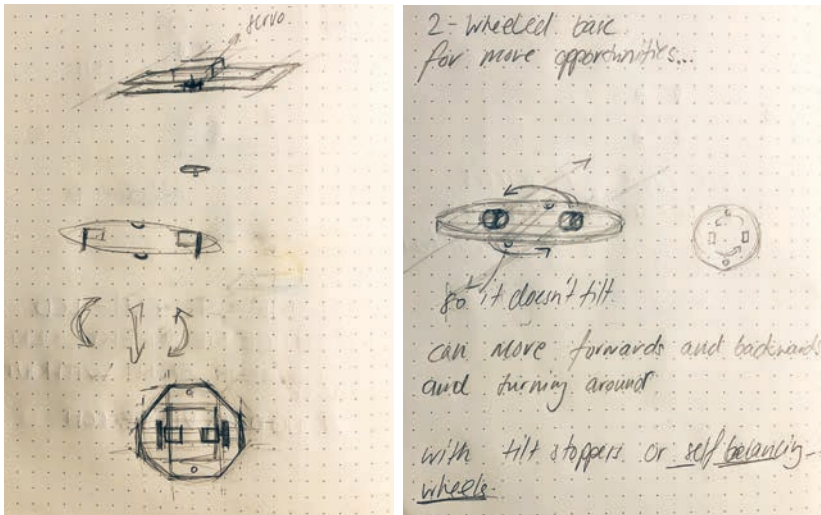
Further testing of the spraying mechanism with water and first tests of the rotating mechanism.



Testing the fit of the outer mould with the injection mechanism and considering the camera placement.

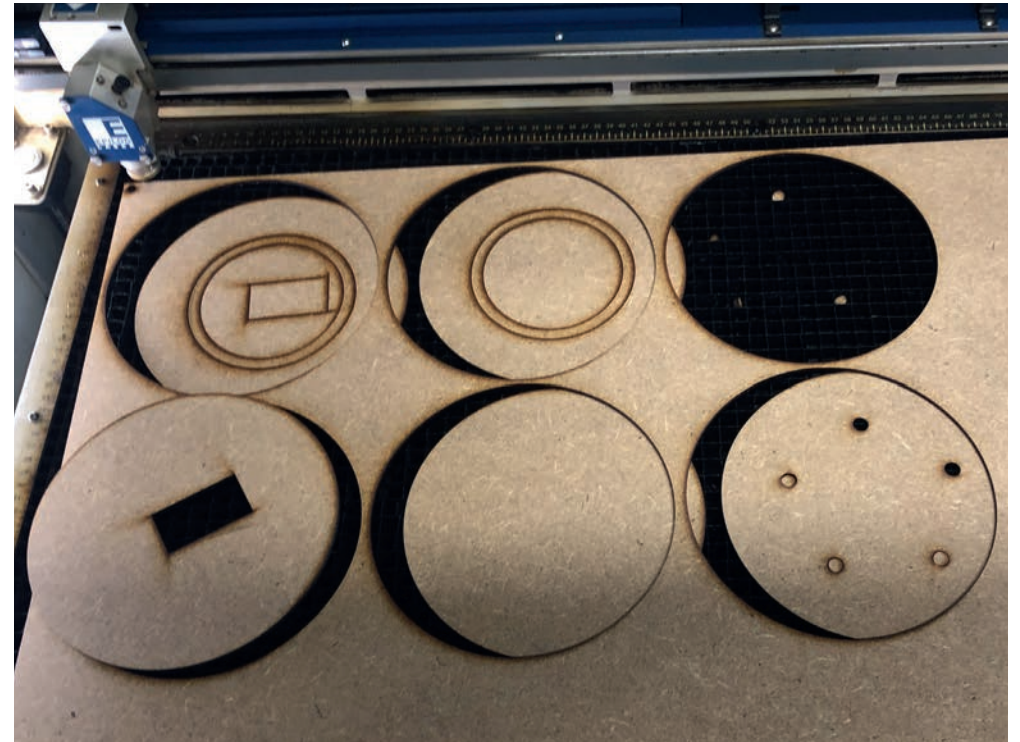
ROTATION MECHANISM

The first idea was to make the rotation function with a servo running in the middle of the platform but we were concerned about the weight.

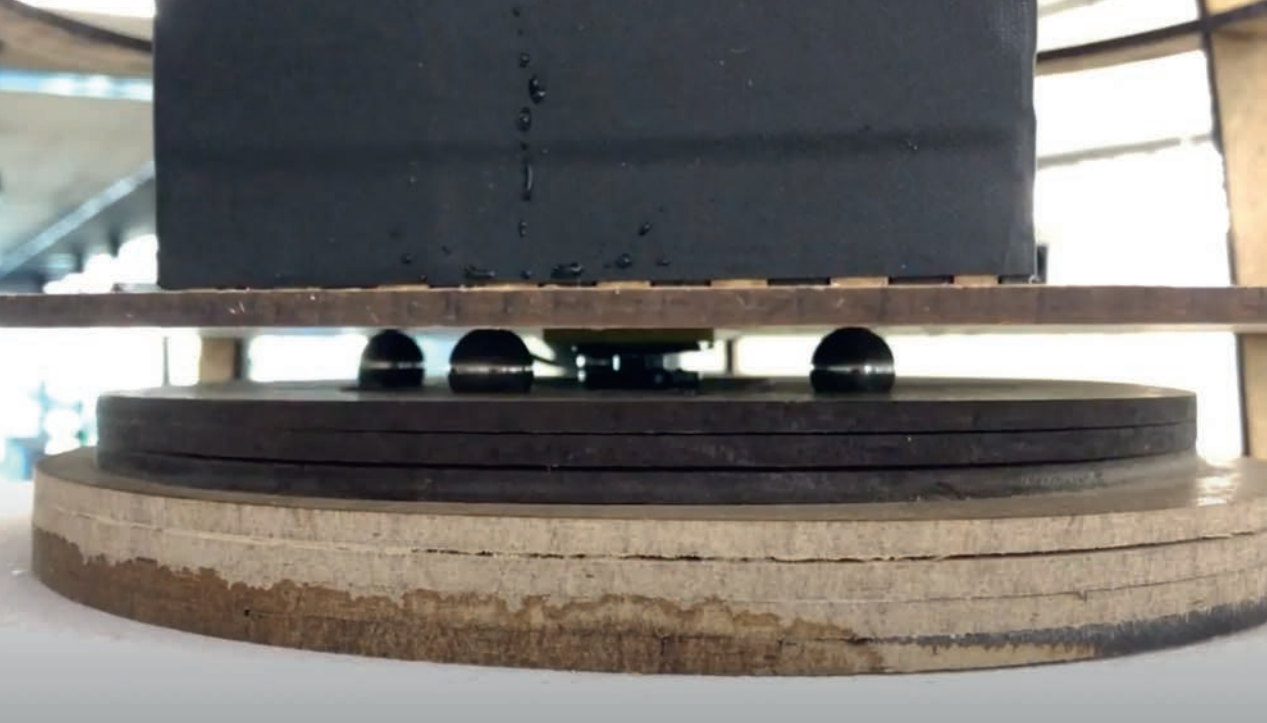


A dropped idea:

A platform with two wheels would give more opportunities to animate the robot. Additionally, you could drive around with it but we decided against it because it would have been too time-consuming to build and code it just for a side function and would not fit into the concept. The two wheels would have kept in balance with two spheres stopping it from tilting or a tilt sensor.



An Idea of a Driving prototype with a kind of ball - Bearing: We had not enough spheres to fill up the track line and weren't sure about if it would make a big difference to a non tracked system which would be easier to build and handle.

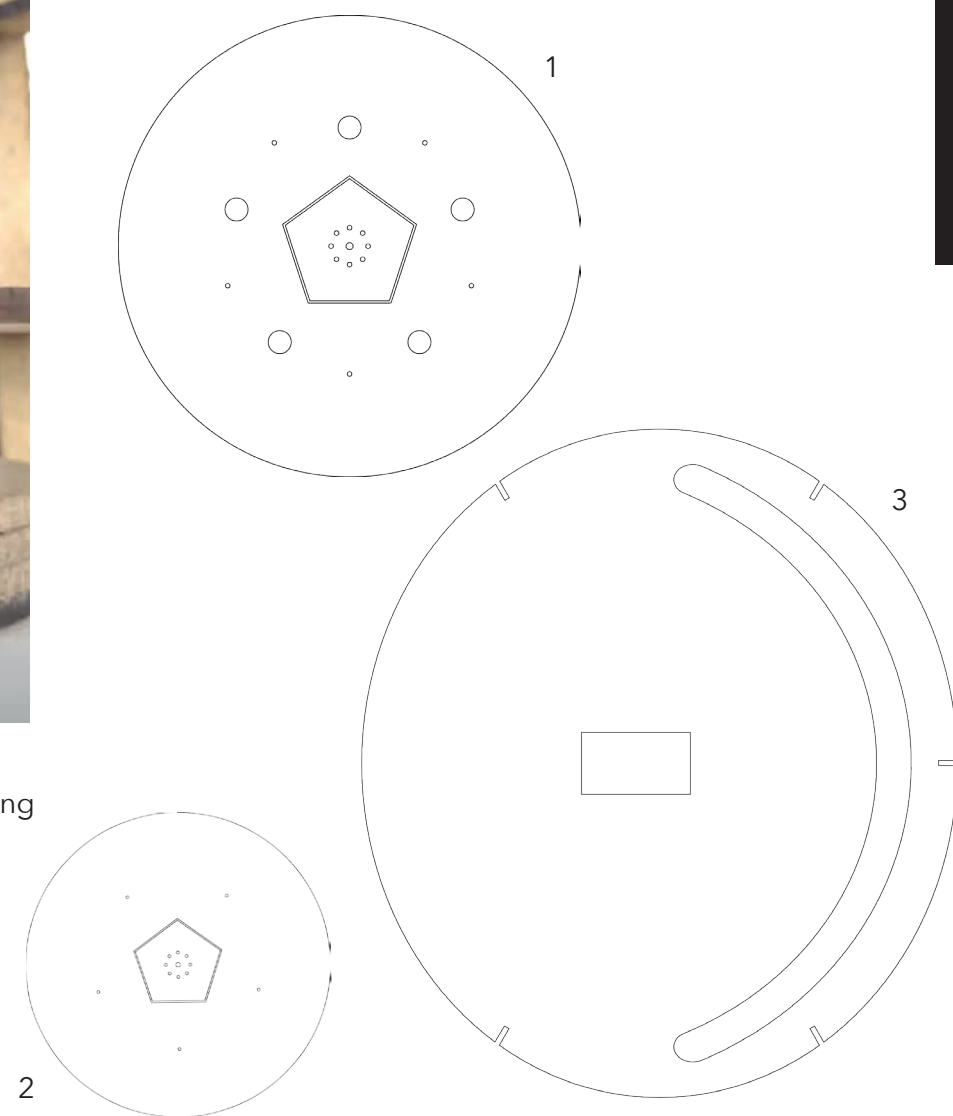


Driving Demonstration Video

<https://drive.google.com/file/d/1Pl1ScizlUqvbjJFggjg-YXE-lVM2JojC/view?usp=sharing>

Final Idea of a Driving prototype

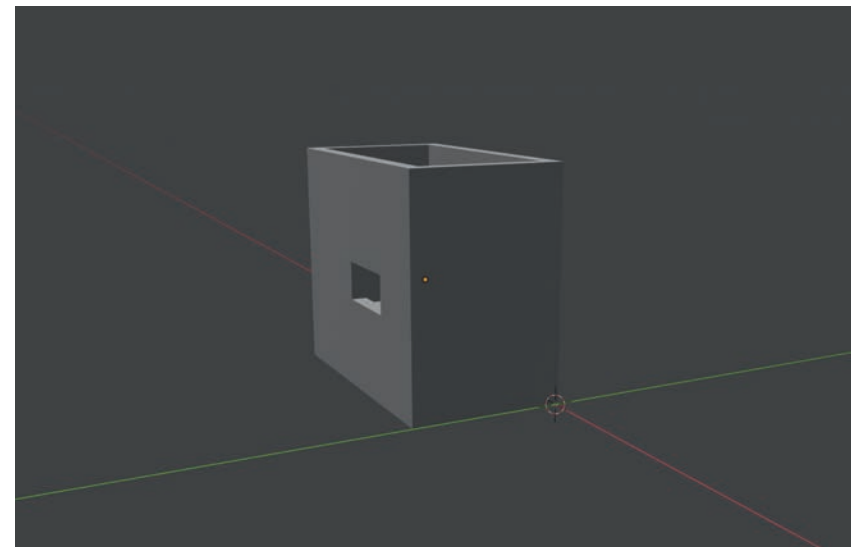
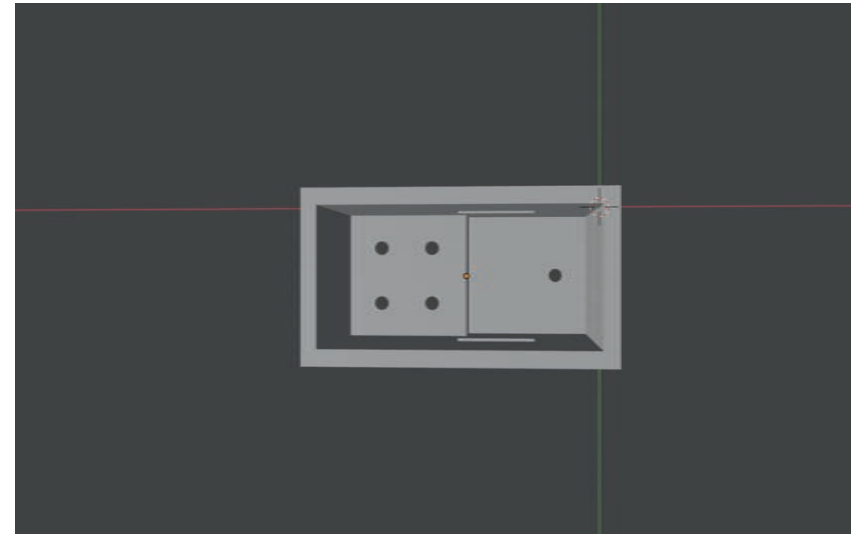
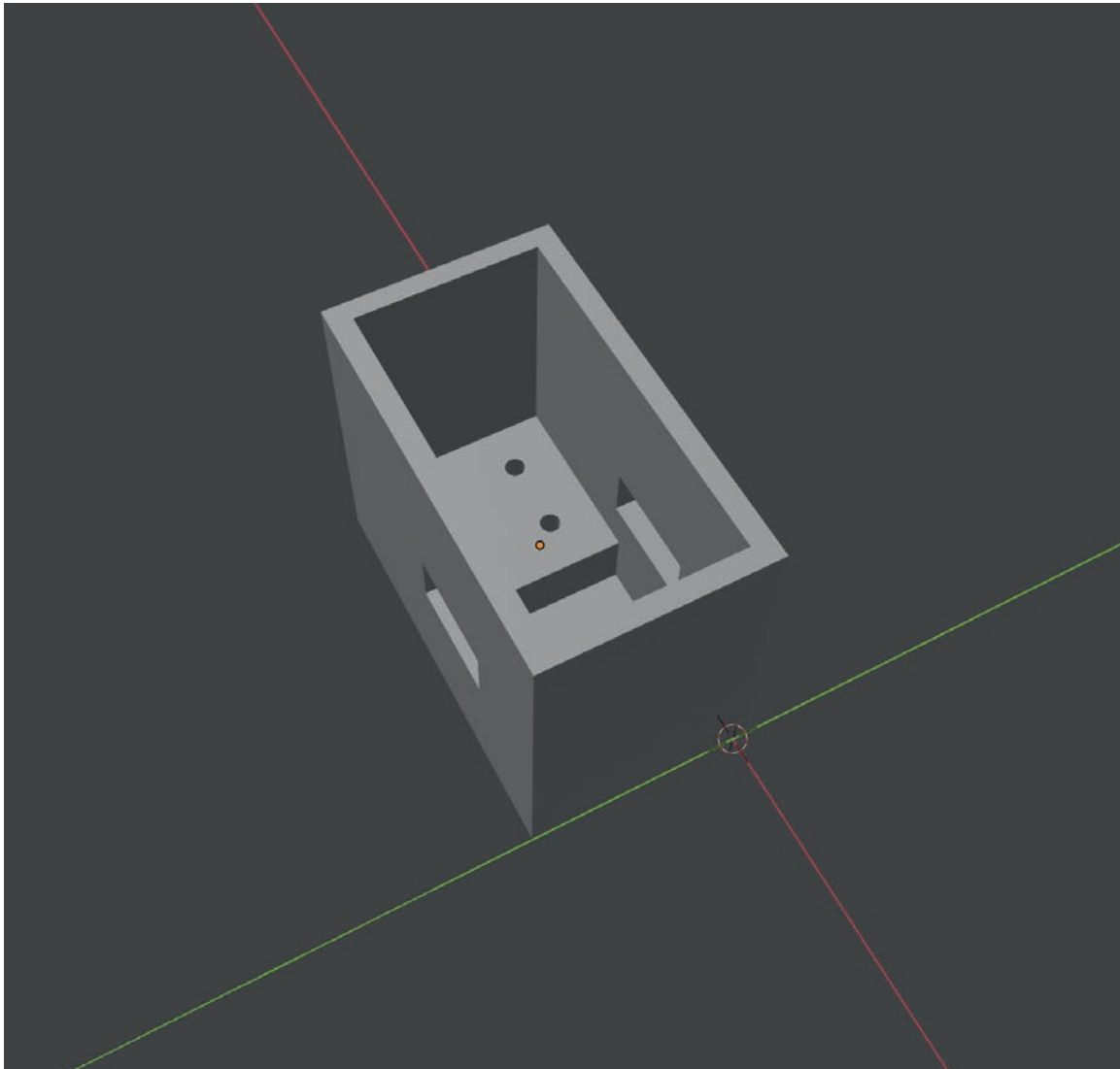
The Servo is attached to a pentagonal which is fitting into a hole with the same shape so it can turn and isn't falling off but also can be quickly removed from each other. The spheres are holding the turning part, take away the weight from the servo and are working as a stabilizer for the whole construction.



1: Upper Layer of the bottom part and the pentagonal in the middle

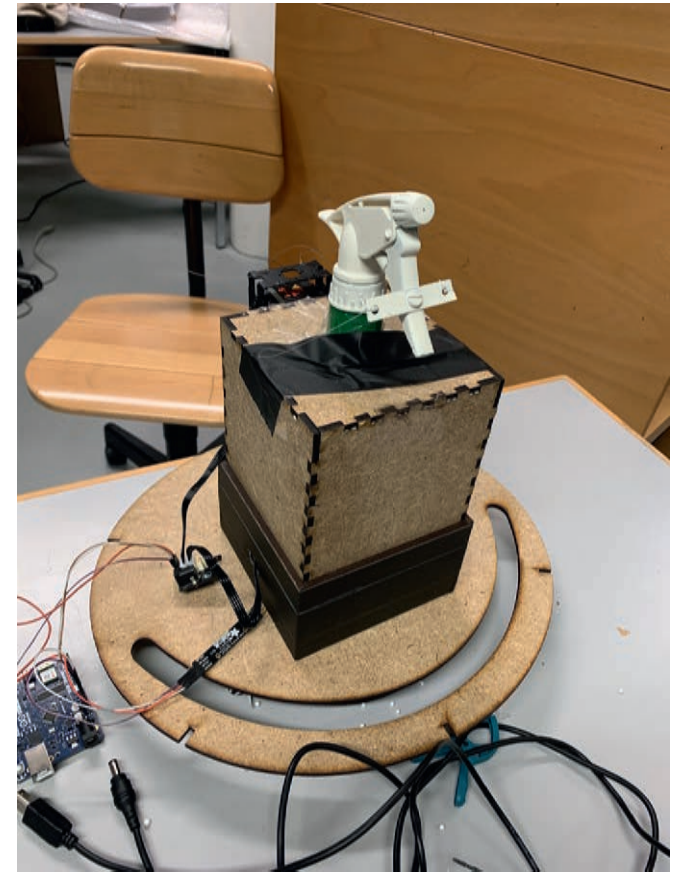
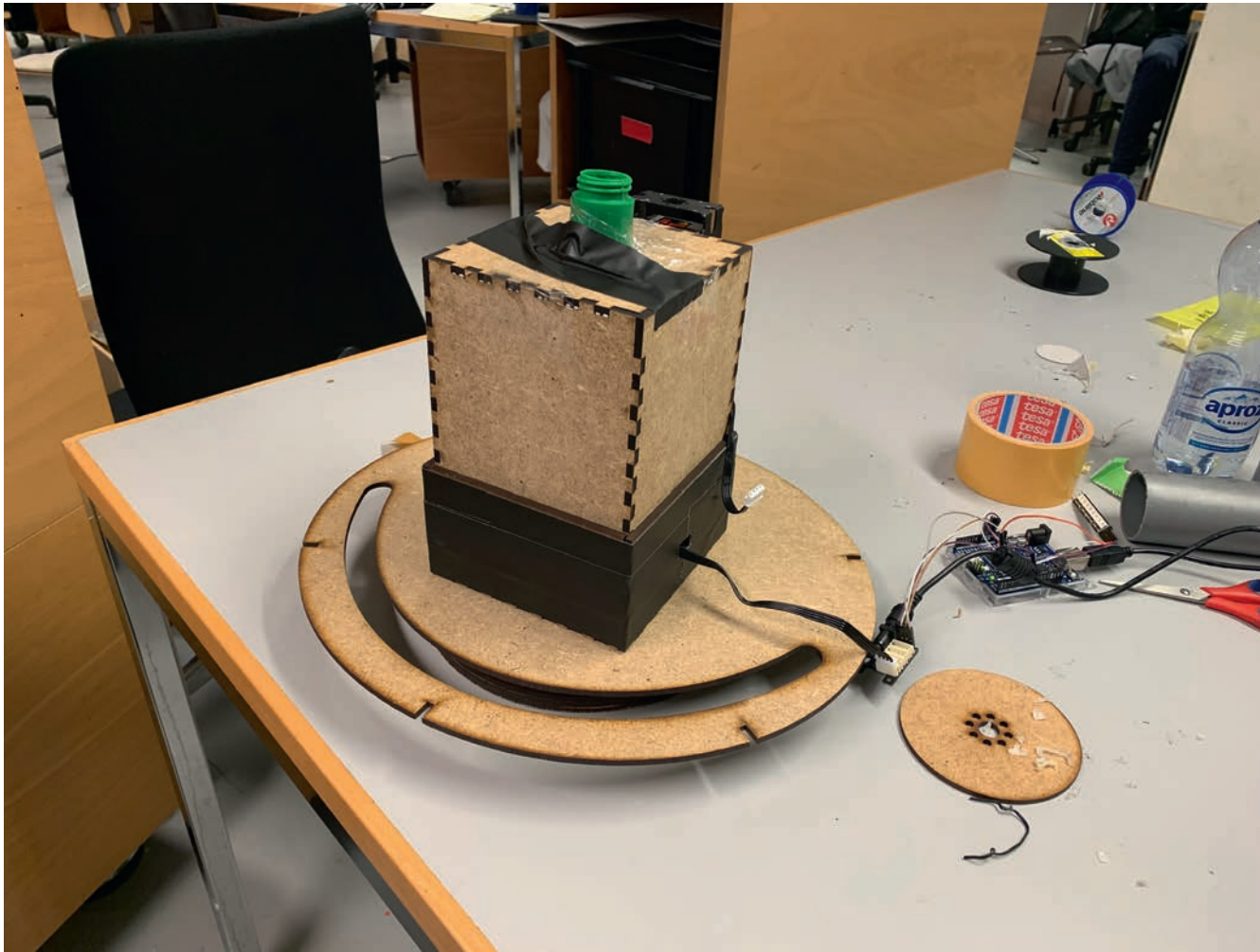
2: Under Layer of the bottom part and the pentagonal in the middle

3: Platform base with a smiley whole for the wires

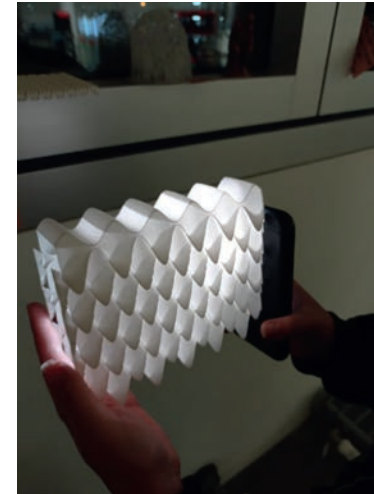


3D - modell Servo case

To connect the servo motor with the elements,
we printed a 3D model.



OUTER SHELL



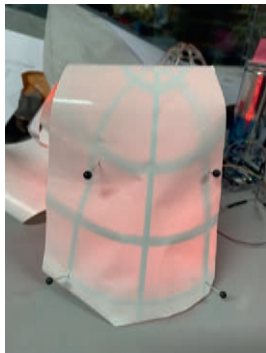
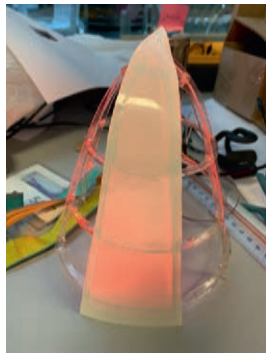
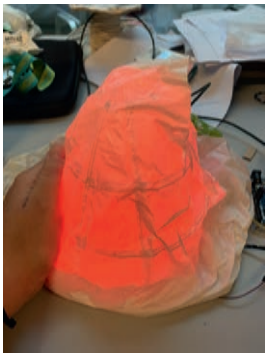
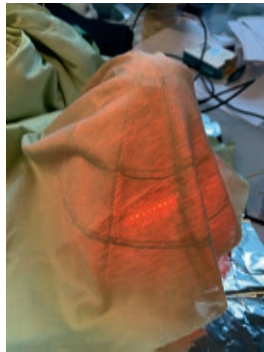
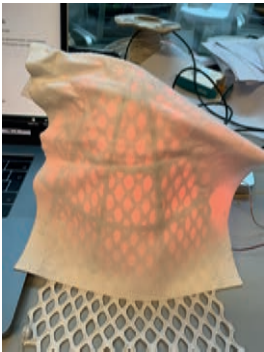
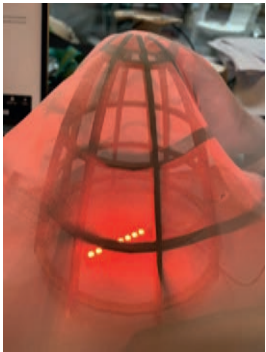
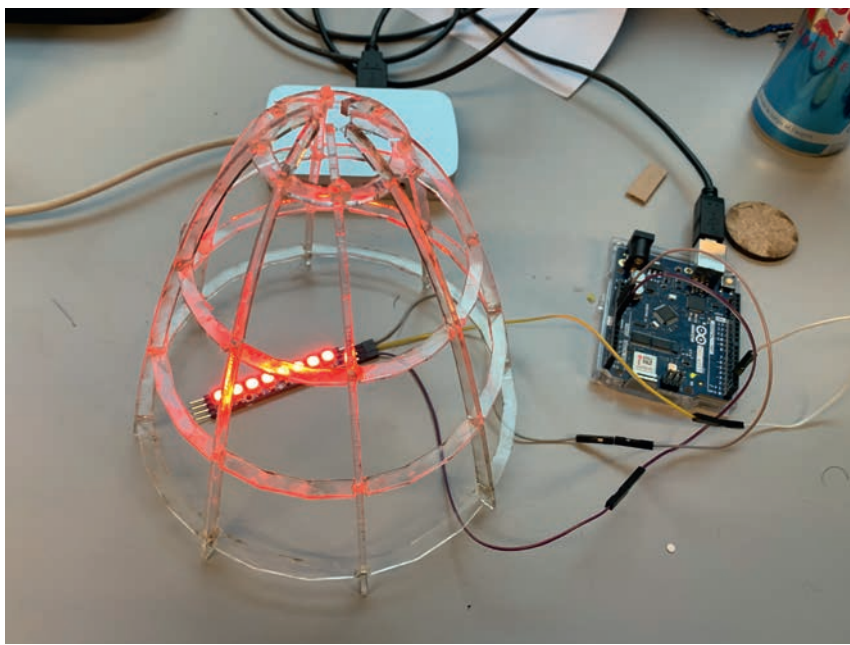
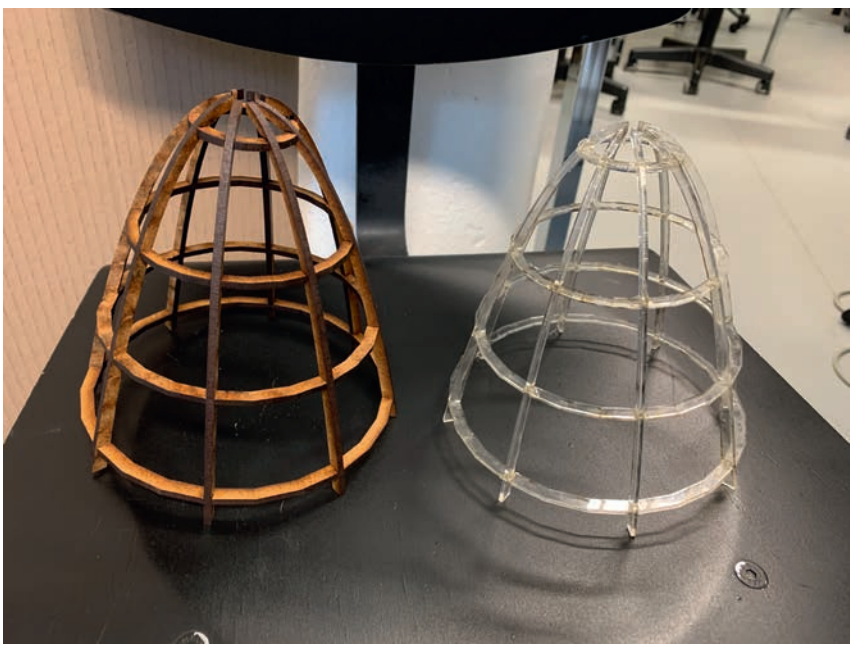
Hier testeten wir die Lichtdurchlässigkeit von 3D gedruckten Elementen.



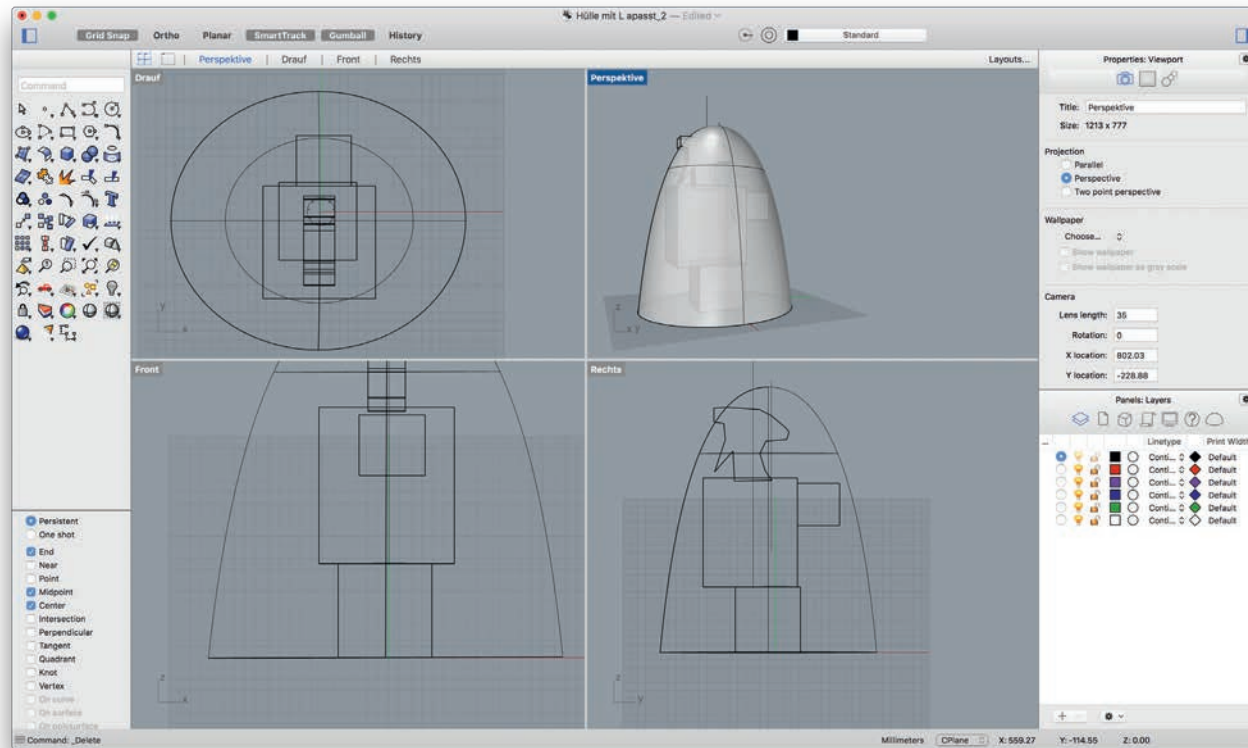
As with the first sketches found form, we first implemented with the 3D program Thinkercad and made first prototypes with cardboard- To test the form in connection with the spraying function and the light transmission of different materials.

We also made even smaller prototypes from Plexiglas and MDF to carry out further light tests.

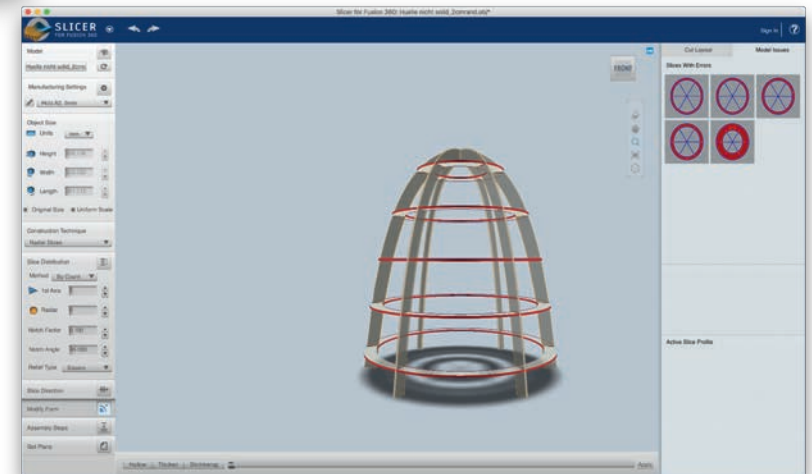


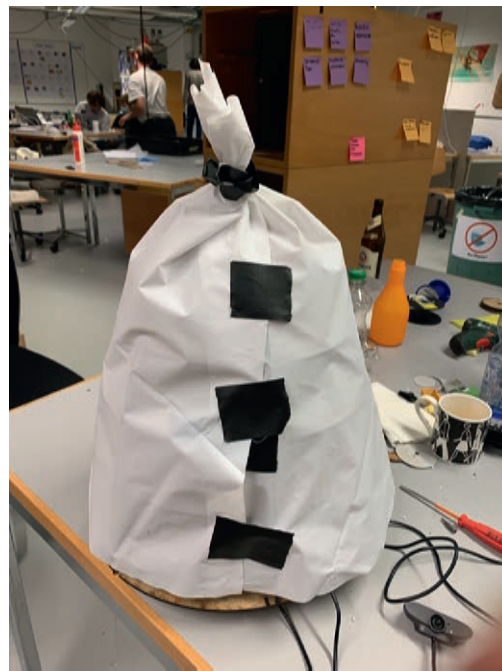
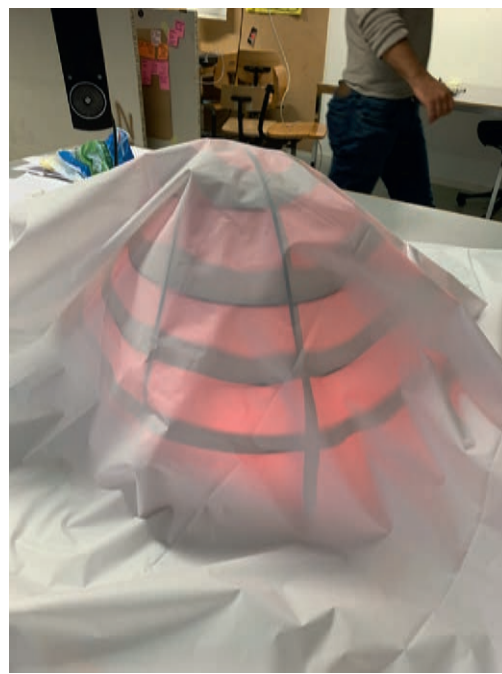


REALISATION



With the help of our lecturer Luke, we were able to build an approximate 3D model of our spray function. This allowed us to adjust the outer shell to the exact proportions.





TECHNOLOGY

We're using in our setup the following materials:



2× - High Torque (HT1)



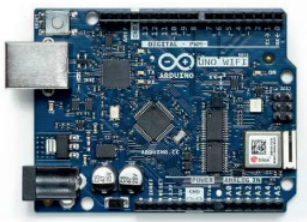
1× - C Bracket for Servo



4× - Neopixel Sticks



1× - LSS Power Hub



1× - Arduino Uno Wifi
REV2



1× - Wasserspray



1× - Computer



1× - Webcam

YOLO MASK DETECTOR

We decided to use the pre-trained open source network YOLO Mask Detection in our project. The network is trained by Florian Bruggisser. (<https://github.com/cansik/yolo-mask-detection>).

This program can recognise three states:

1. Mask on.
2. Mask not worn correctly.
3. No mask at all.

Our first step was to connect the Processing sketch with the Arduino and test the three states with a simple LED.



PROCESSING

```
case 0:
    stroke(120, 80, 100);
    if (moodtest != angry && moodtest != anoyed) {
        moodtest = happy;
    }
    break;
case 1:
    stroke(40, 80, 100);
    if (moodtest != angry) {
        moodtest = anoyed;
    }
    break;
case 2:
    moodtest = angry;
    stroke(0, 80, 100);
    break;
}

rect(detection.getX(), detection.getY(), detection.getWidth(), detection.getHeight());

fill(0);
String label = yolo.getLabels().get(detection.getClassId());
text(label + " " + nf(detection.getConfidence(), 0, 2), detection.getX(), detection.getY());
}
if (moodtest == angry) {
    mood = angry;
} else {
    averageMood = averageMood*0.95;
    averageMood += float(moodtest)*0.05;

    mood = round(averageMood);

if (lastMood != mood) {
    lastMood = mood;
    port.write(str(mood));
    port.write("\n");
}
```

Processing Code

ARDUINO

As the code indicates, we send the emotional state to Arduino by serial port when it changes. By the mood test we mean angry, annoyed or neutral.

The mood test is angry if a person is present without a visible mask. It is also annoyed if there is someone who is not wearing the mask correctly. If people wear the mask correctly, the state will be happy. In neutral mode there is no one to see.



Image Source: Twitter @BAG_OFSP_UFSP

ARDUINO

180 degree movement:

```
if (counting) {  
  xPosition.move(ServoPosition);  
  
  if (ServoPosition > 900) {  
    ServoSpeed *= -1;  
  }  
  
  if (ServoPosition < -900) {  
    ServoSpeed *= -1;  
  }  
  
  ServoPosition += ServoSpeed;  
}
```

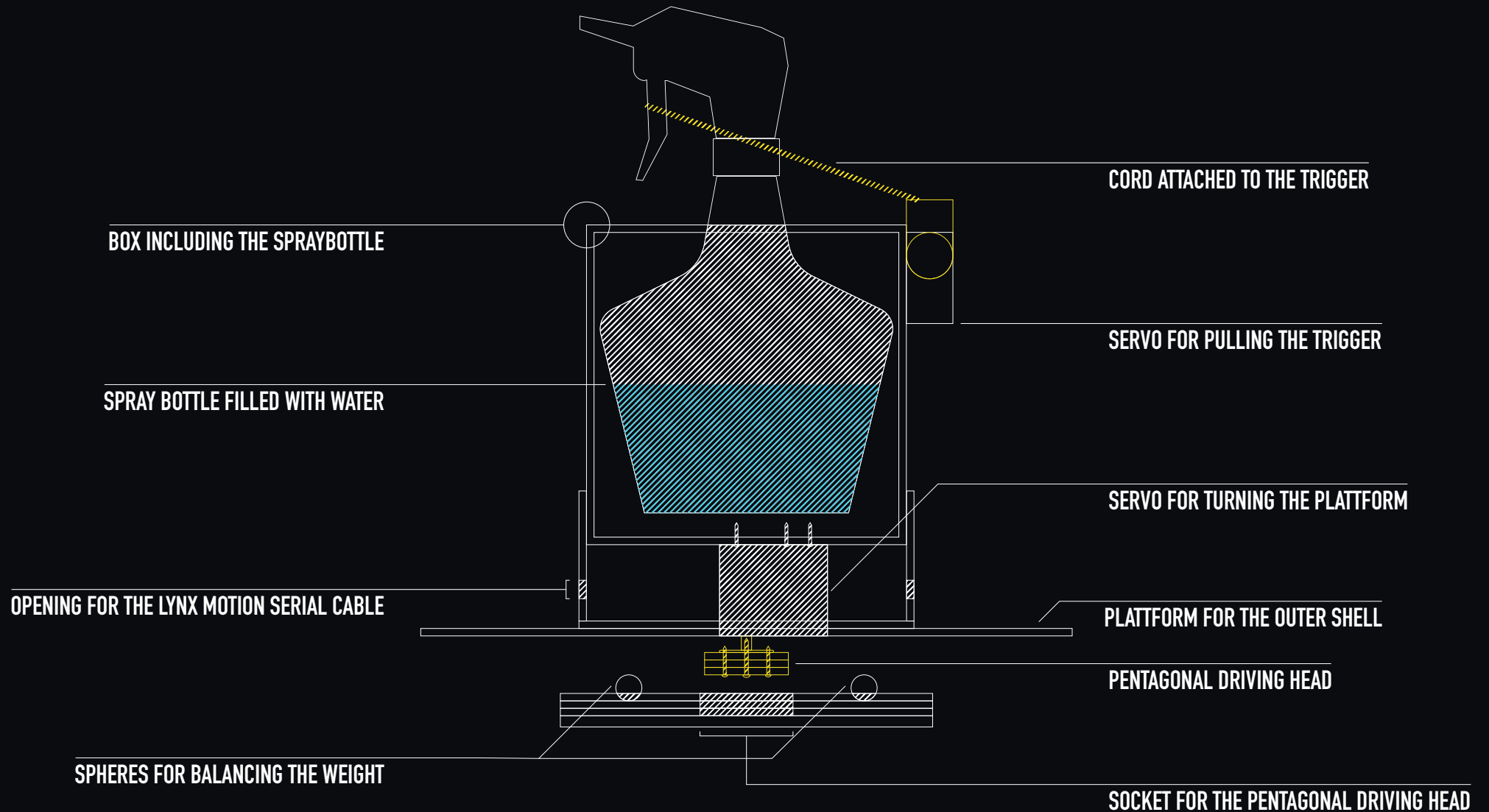
Annoyed:

```
if (mood == annoyed) {  
  counting = false;  
  sprayPosition.move(0);  
  
  if (lastMood != annoyed) {  
    startTime = millis();  
  }  
  
  float progress = (millis() - startTime) / duration;  
  int numOnLeds = round(progress * numPixels);  
  
  if (progress >= 1.0) {  
    mood = angry;  
  }  
  
  for (int i = 0; i < numOnLeds; i++) {  
    pixels->setPixelColor(i, pixels->Color(255, 0, 0));  
    pixels->show();  
  }  
}
```

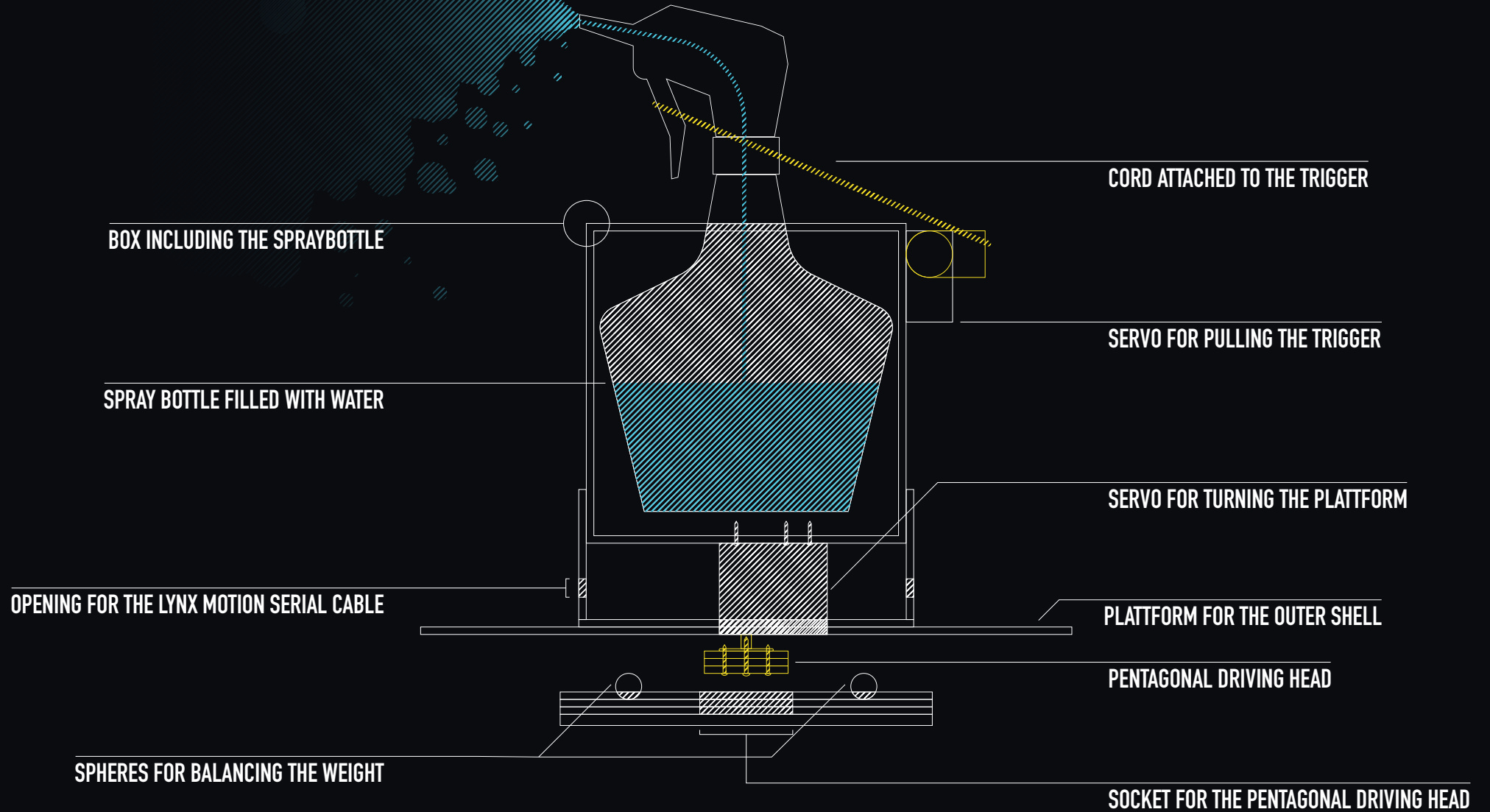
Angry:

```
if (mood == angry) {  
  counting = false;  
  for (int i = 0; i < numPixels; i++) {  
    pixels->setPixelColor(i, pixels->Color(255, 0, 0));  
    pixels->show();  
    sprayPosition.move(-900);  
  }  
}
```

PASSIVE STATE



ACTIVE STATE





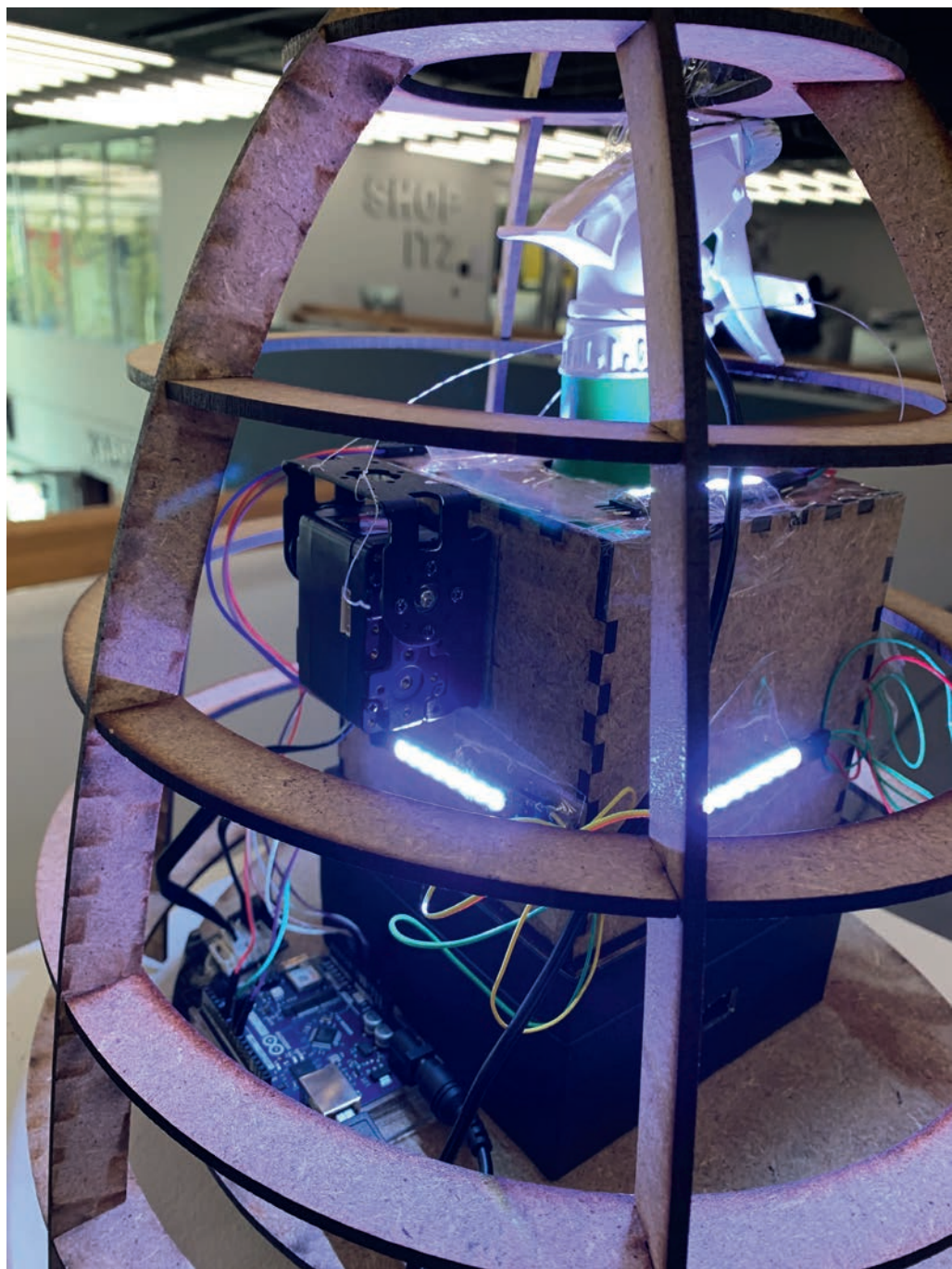
Heute

15.00 Konzert
Klausen Ensemble / Quartet 2020
Kammeraal 1, Ebene 1
18.30 Konzert
Klausen Ensemble / Quartet 2020
Kammeraal 1, Ebene 1

Morgen

17.00 Konzert
Klausen Ensemble and Viola
Kammeraal 2, Ebene 2
18.00 Konzert
Klausen Ensemble
Kammeraal 1, Ebene 1







Daniela & Baran:

Brainstorming, Rapid prototyping, Functional scenario,
CardBoard prototype, Realization of finished prototype

Baran:

Electronic and Coding

Daniela:

Research behaviour and emotions, Sketches,
External construction, Material testing

Kimon:

Brainstorming, Rotation mechanism,
Realization of finished prototype, Schematic diagram Function